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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/696,151 | 10/29/2003 | Kangguo Cheng | FIS920030311US1 | 5490 |

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H. Daniel Schnurmann
IBM Corporation
Dept. 18G, Building 300-482
2070 Route 52
Hopewell Junction, NY 12533

EXAMINER

LANDAU, MATTHEW C

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| ART UNIT | PAPER NUMBER |
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2815

DATE MAILED: 03/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/696,151

Applicant(s)

CHENG ET AL.

Examiner

Matthew Landau

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 December 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7,9,10,12-14 and 19-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7,9,12-14,19-21 and 23-26 is/are rejected.
- 7) ☒ Claim(s) 10 and 22 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 4-7, 19, and 20 are objected to because of the following informalities:

Regarding claims 4-7, 19, and 20, the limitation “a strap” is objected to since claims 1 and 12 already define a strap. In claims 4, 6, and 7, “a strap” should be changed to read “the strap is”. In claims 5, 19, and 20, the limitation “a strap” should be changed to read “the strap”.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 12-14, 19, 20, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Mandelman et al. (US Pat. 2002/0105019, hereinafter Mandelman).

Regarding claims 12-14, Figures 6A-6M of Mandelman disclose a method of forming DRAM cells, comprising: forming trenches 16 in a semiconductor substrate 10; forming cell capacitors in a bottom portion of the trench (paragraph [0051]); forming cell transistors 24/32/36 in a top portion of the trench; and for each DRAM cell, providing a collar 18 between the cell capacitor and the cell transistor, the collar being disposed in the substrate, wholly outside of the trench; for each DRAM cell, forming a recess (divot) in a top inside corner of the collar; and embedding a strap 26 in the recess (approximately middle of paragraph [0054]). Note that the

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divot etched into the collar can be considered a recess. Since the strap 26 is formed in the divot, it is considered that Mandelman discloses embedding a strap in the recess.

Regarding claims 19 and 26, Figures 6A-6M of Mandelman disclose the strap 26 extends no higher than the collar. Note that the highest point of the strap 26 is level with the highest point of collar 18. In other words, an upper surface of the buried strap does not extend above an upper surface of the collar.

Regarding claim 20, Figures 6M of Mandelman discloses a strap 26 disposed in the trench; and the strap is laterally surrounded by the collar. As shown in Figures 6M and Figure 2 (showing the out-diffused region 24 which corresponds to the strap), the strap is formed on only one side of the trench, in an upper portion of the collar (see also paragraph [0054]), extending around half of the circumference of the trench. Therefore, it can be considered that the collar surrounds the buried strap, wherein the lateral direction is the direction around the circumference of the cylindrical trench.

Claim Rejections - 35 USC § 103

Claims 1-7, 9, and 12-14, 20, 21, and 23-25 are rejected under 35 U.S.C. 102(a) as anticipated by Tews et al. (US Pat. 6,599,798, hereinafter Tews) or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tews in view of the admitted prior art.

Regarding claims 1-3, Figure 12 of Tews discloses a DRAM cell comprising: a semiconductor substrate; a trench extending into the substrate; a cell capacitor disposed in a bottom portion of the trench; a cell transistor (col. 5, lines 20-22) disposed in a top portion of the

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trench above the cell capacitor; a node conducting element (poly in trench, col. 5, lines 3-6); and a collar (thick dark portion) disposed about the node conducting element (col. 5, lines 5-7); wherein: the collar is disposed in the substrate, wholly outside of the trench, between the cell capacitor and the cell transistor; further comprising: a strap 28 disposed in the trench and having an outside peripheral surface; and the collar is laterally adjacent and surrounds the outside peripheral surface of the buried strap. Tews discloses a vertical transistor is formed after the structure of Fig. 12 is completed (col. 5, lines 20-22). Therefore, it is believed that the collar will be between the capacitor and the transistor. If for some reason this is found to not be inherent, it would certainly be obvious to have the collar between the capacitor and the transistor as shown in Figure 1 of the instant application (prior art) for the purpose of fabricating a functional DRAM device. Note that if it can be considered the trench has a bottle like shape, the collar is the thick dark colored portion around the neck of the bottle and the strap 28 is the bottle cap (as shown in Figure 12). It is clear the collar surrounds at least a portion (lower portion) of the outside periphery of the strap.

Regarding claims 4 and 5, Figure 12 of Tews discloses the strap 28 is disposed between the node conducting element and the cell transistor, wherein the strap is self-aligned with the collar.

Regarding claim 6, Figure 12 of Tews discloses a strap 28 disposed in the trench at substantially the same depth as the collar.

Regarding claims 7 and 20, Figure 12 of Tews discloses the strap 28 is disposed in the trench and laterally surrounded by the collar.

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Regarding claim 9, Figure 12 of Tews discloses the strap is embedded into a top surface of the collar.

Regarding claims 12-14, Figures 2-12 of Tews disclose a method of forming DRAM cells, comprising: forming trenches in a semiconductor substrate; forming cell capacitors in a bottom portion of the trench; forming cell transistors in a top portion of the trench; and for each DRAM cell, providing a collar (thick, dark portion) between the cell capacitor and the cell transistor, the collar being disposed in the substrate, at wholly outside of the trench; for each DRAM cell, forming a recess in a top inside corner of the collar; and for each DRAM cell, embedding a strap 28 in the recess. Note that if it can be considered the trench has a bottle like shape, the collar is the thick dark colored portion around the neck of the bottle and the strap 28 is the bottle cap (as shown in Figure 12). Figure 12 clearly shows a recess in the upper portion of the collar, and that the strap is embedded in the recess.

Regarding claim 21, Figure 12 of Tews discloses a recess disposed in a top inside corner of the collar; and the strap 28 extends into the recess in the top inside corner of the collar.

Regarding claims 23 and 24, Figure 12 of Tews discloses the strap 28 is disposed in the trench at substantially a same depth as the collar; and the collar extends deeper into the trench than the strap and covers a bottom surface of the strap.

Regarding claim 25, Figure 12 of Tews inherently discloses constraining outward diffusion of the strap by the laterally-surrounding collar; and constraining downward diffusion of the strap with the collar.

Allowable Subject Matter

Claims 10 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 10, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including the strap extends no higher than the collar.

Regarding claim 22, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including the strap is fully vertically embedded in the collar and it is laterally surrounded by the collar.

Response to Arguments

Applicant's arguments filed December 16, 2004 have been fully considered but they are not persuasive.

In response to Applicant's argument that the buried strap is on top of the collar in Mandelman and Tews, as stated in the above rejection, the structures shown in both Mandelman and Tews have a strap that can be considered to be surrounded by the collar, not just on top of. For instance, Figure 12 of Tews discloses a strap 28 that is at least partially surrounded by the collar. It is clear from that figure that the collar has a recess in which the strap is embedded. Applicant's argument regarding Mandelman now only applies to claim 20, since the rejection of

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claim 1 over Mandelman has been withdrawn. Figures 2 and 6M of Mandelman disclose a strap 26 that is laterally surrounded by the collar 18. As stated above, the strap is formed on only one side of the trench, in an upper portion of the collar, extending around half of the circumference of the trench. Therefore, it can be considered that the collar surrounds the buried strap, wherein the lateral direction is the direction around the circumference of the cylindrical trench.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached

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on (571) 272-1664. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



TOM THOMAS
SUPERVISORY PATENT EXAMINER

Matthew C. Landau

Examiner

February 22, 2005